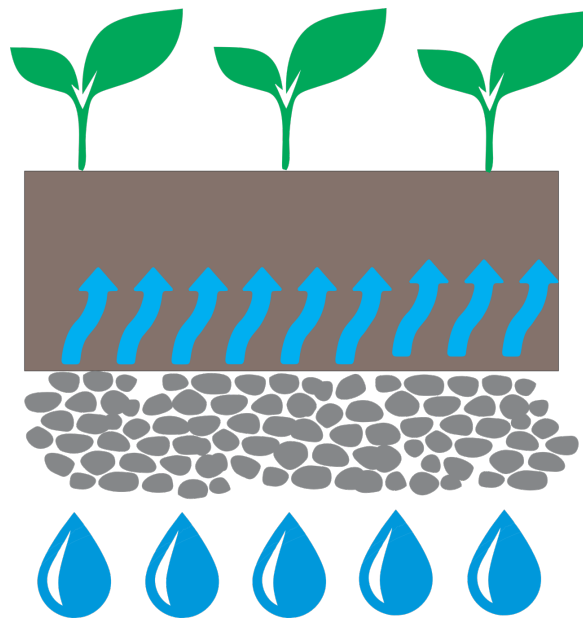




Climate-smart farmer field school catalogue

# Wicking beds



Heat tolerance



Water saving



Extreme weather event



CO<sub>2</sub>



CH<sub>4</sub>



Energy saving



Increased productivity

Adaptation

Mitigation

Productivity

Funded by



## ADAPTATION



Wicking beds can help plants withstand high temperatures and droughts by maintaining consistent moisture levels in the root zone, which reduces heat stress on plants.



The wicking action allows for efficient water usage by drawing moisture upward from a reservoir at the bottom, reducing water loss through evaporation and ensuring plants have access to water during dry periods.



During flooding events wicking beds provide protection from inundation due to their above ground physical structure

## MITIGATION



Wicking beds can be integrated into agroecosystems that utilize organic matter as a growing medium. Healthy soils act as carbon sinks, sequestering CO<sub>2</sub> from the atmosphere



Healthy organic soil reduces emissions of methane (CH<sub>4</sub>).

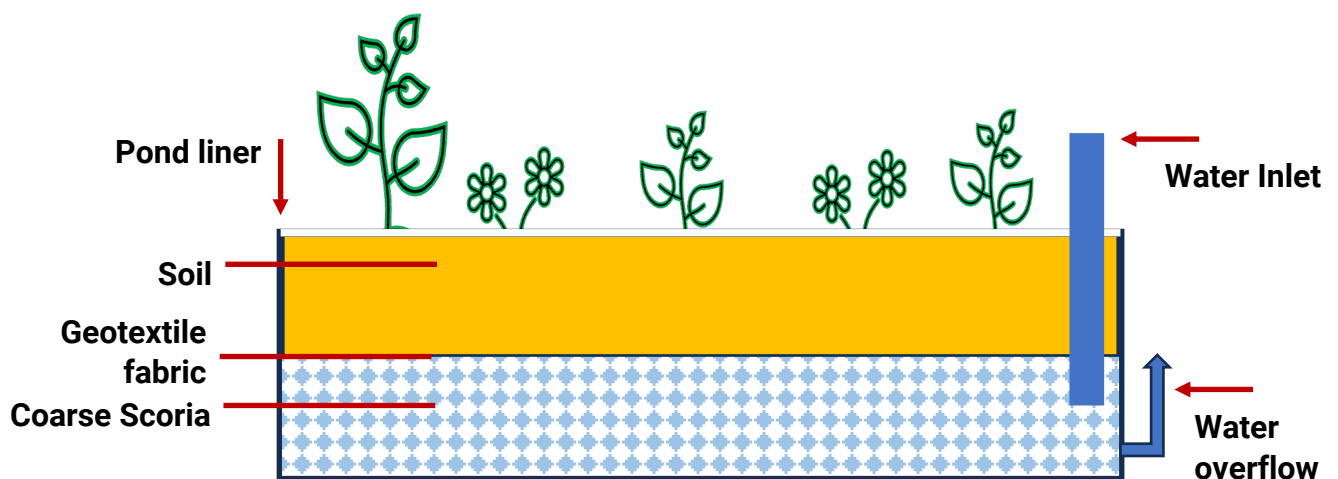


Wicking beds require less water compared to traditional irrigation methods, reducing the energy required for pumping and distributing water. Additionally, the reduced need for synthetic fertilizers in wicking beds can lower the energy inputs associated with fertilizer production and application.

## PRODUCTIVITY



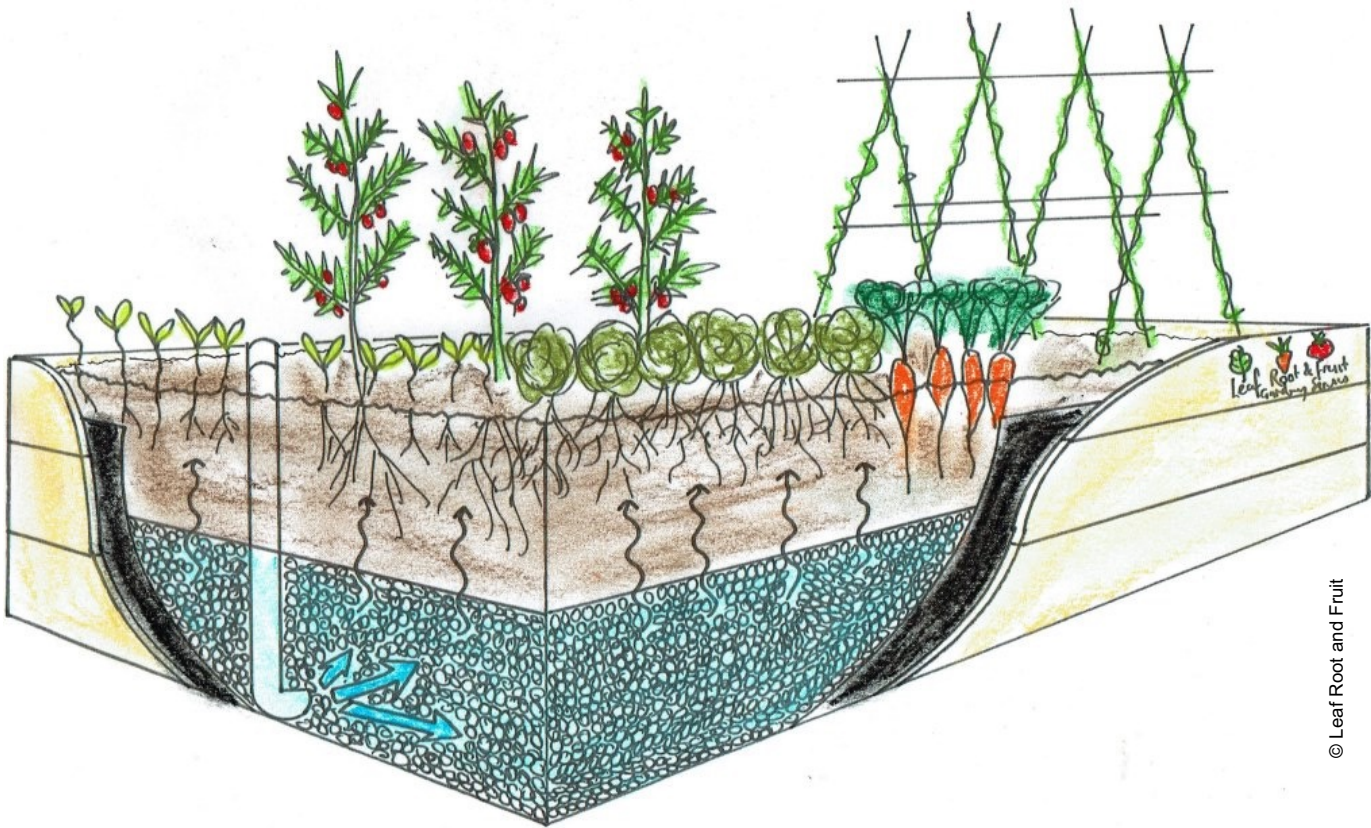
Wicking beds provide consistent moisture to plant roots, promoting healthy growth and development, leading to increased yields.



Source: Authors' own elaboration.

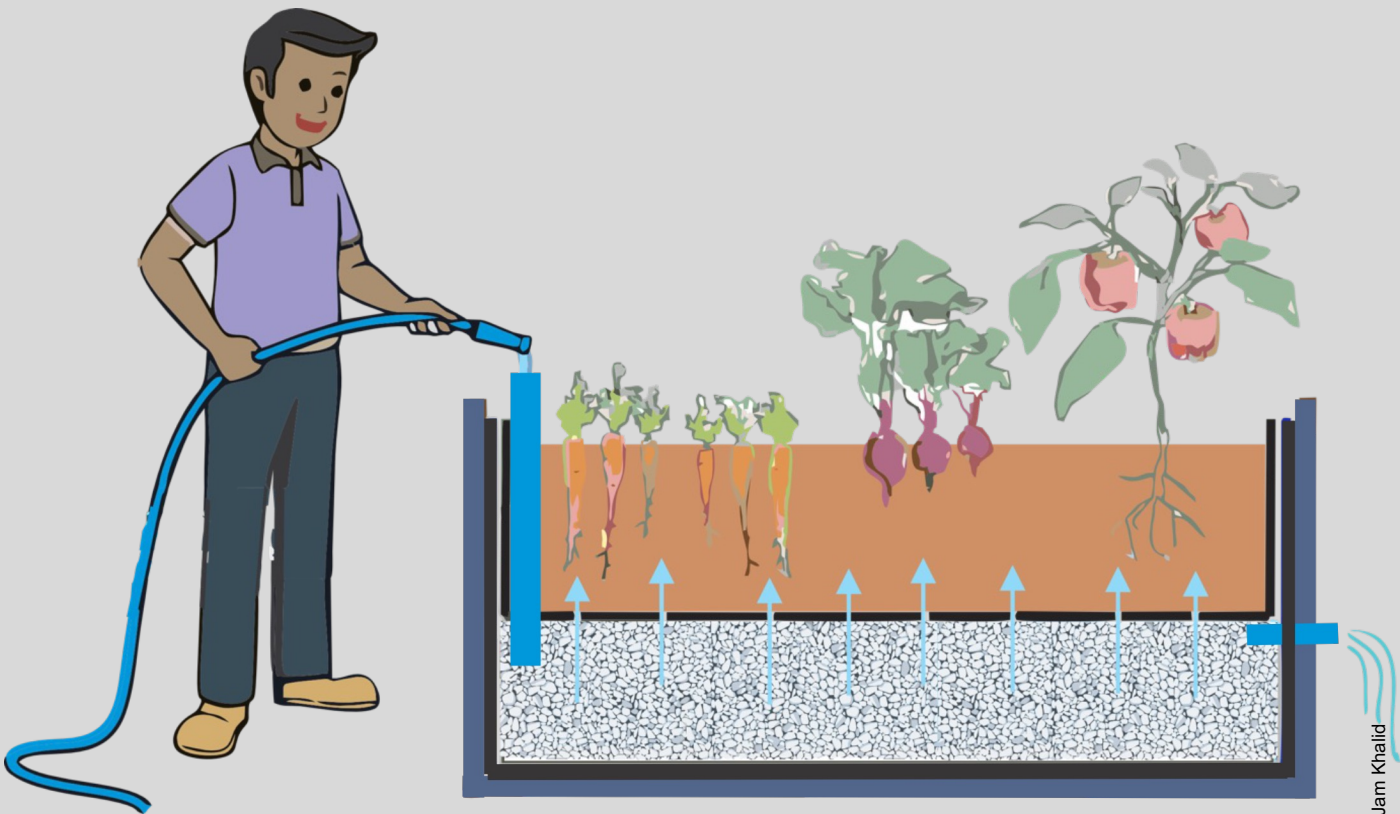
# Description

The wicking bed system is a way of growing plants in which water wicks up from an underground water reservoir. Plants draw water from a reservoir below through capillary action, promoting water efficiency. They are popular for small-scale urban agriculture due to their simplicity, scalability, and potential for significant water savings, making them suitable for various urban settings. Wicking beds technology utilizes water's unique properties, such as surface tension forces, to create an efficient and sustainable system. By using an underground reservoir filled with coarse organic material, water holding capacity is increased, allowing for deeper irrigation in open beds (if built directly on the ground or slightly dug into it) for deep-rooted plants and shallower irrigation in closed beds (contained within a waterproof structure, like a raised bed or container) for shallow-rooted varieties. Overall, this technology offers an innovative solution to irrigation challenges, fostering water conservation and supporting enhanced plant growth.



© Leaf Root and Fruit

Source: Leaf Root and Fruit. 2024. Self-watering wicking beds. [Cited 2 September 2024]  
<https://www.leafrootfruit.com.au/gardens/wicking-beds/>



Source: Authors' own elaboration.

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## Benefits

- Reduces water usage by up to 50 percent (VEG, 2024).
- Optimal plant performance in both dry and wet climates.
- Stores water in a reservoir and utilizes capillary action (Botanic Garden, 2024).
- Minimizes evaporation and runoff.
- Promotes microbial activity and enhances soil structure.
- Improves nutrient availability for plants.
- Facilitates anaerobic decomposition.
- Adaptable for various plants both deep-rooted trees and shallow-rooted vegetables.
- Eliminates runoff.
- Reduces environmental pollution.
- Relatively inexpensive to set up with local available material.
- Easy to operate once basic principles are understood.
- Promotes healthier plant growth compared to conventional methods.
- Wicking beds can help control surface pests.
- Gradual moisture reduction in the root zone benefits plant development.
- Aligns with efforts to adapt to climate change.
- Represents a sustainable agricultural practice.
- Contributes to food security and environmental sustainability.

## Adoption feasibility

High due to:

- Enables production of fresh, nutritious vegetables.
- Requires little space.
- Feasible for urban and small-scale agriculture.
- Requires understanding of only basic principles.
- Affordable setup and maintenance.
- Versatile for various plant types.
- Potential for significant water savings.

## Why this has not been practiced?

- Lack of awareness.
- Traditional farming practices prevail.
- Initial investment may deter adoption.
- Limited access to materials or resources.
- Perceived complexity or unfamiliarity with concept.

## Other climate-smart agriculture practices combined

- Composting
- Integrated pest management
- Mulching
- Improved varieties

## Enabling services

Agreement of climate smart farmer field school community with the local (public and private) service providers for quality service provision for:

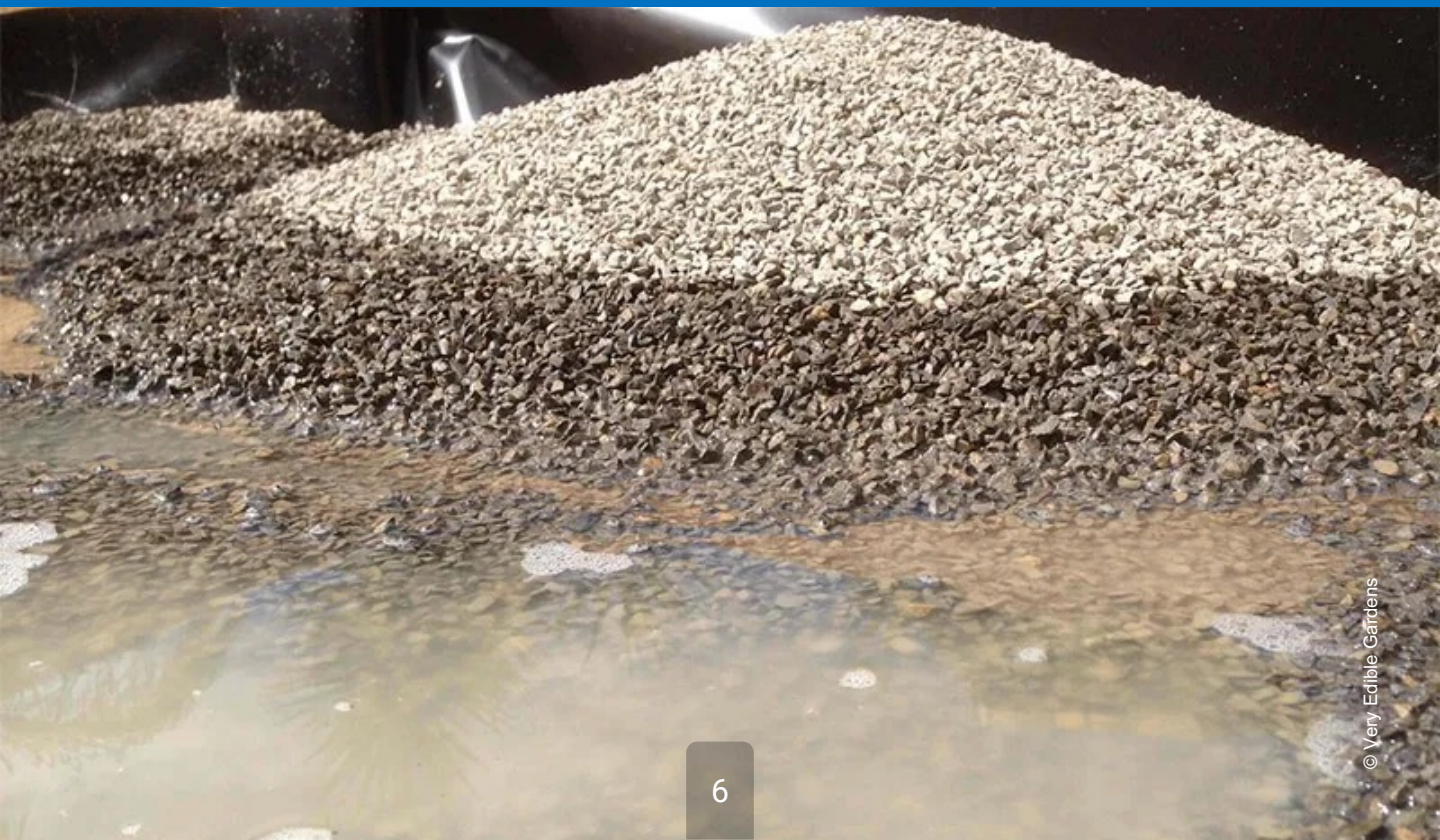
- Quality wicking beds provision.
- Quality seed and plants provision.



## Wicking beds design theory

- Container** The bed is usually constructed using a variety of materials such as wood, plastic, or metal. The container should be watertight to hold the water reservoir.
- Water reservoir** At the base of the bed, a reservoir is created using a waterproof barrier such as a pond liner or thick plastic sheeting. This reservoir holds the water that will be drawn up into the soil.
- Wicking medium** On top of the reservoir, a layer of coarse material such as gravel, coarse sand, or scoria is placed. This layer acts as a wick, drawing water up from the reservoir through capillary action.
- Separator** A barrier, often made of geotextile fabric, is placed on top of the wicking medium to prevent soil from clogging the wick and to separate the soil from the reservoir.
- Growing medium** Above the separator, the bed is filled with a suitable growing medium such as potting mix, compost, or garden soil. This is where plants will grow.
- Water inlet** A pipe or tube is installed to allow water to be added to the reservoir without disturbing the soil above.
- Overflow drain** To prevent waterlogging, an overflow drain is incorporated into the design. This drain allows excess water to escape once the reservoir is full.

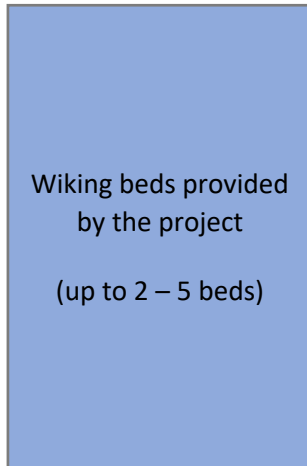
Note: The reservoir should be no more than 11 inches deep and the planting medium the same. This is because capillary action cannot move water upward more than 11  $\frac{3}{4}$  inches (Ray Jess, 2019).



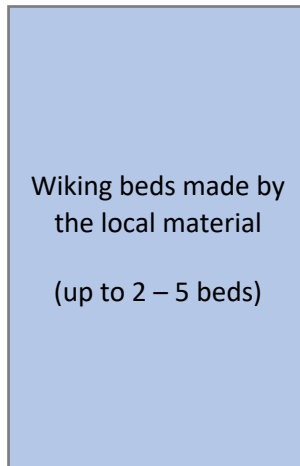
# Field school learning experiments

(Select at least two options for comparison)

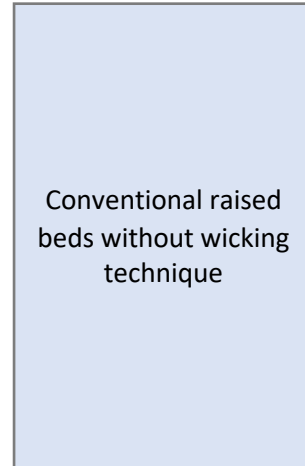
Option 1



Option 2



Option 3

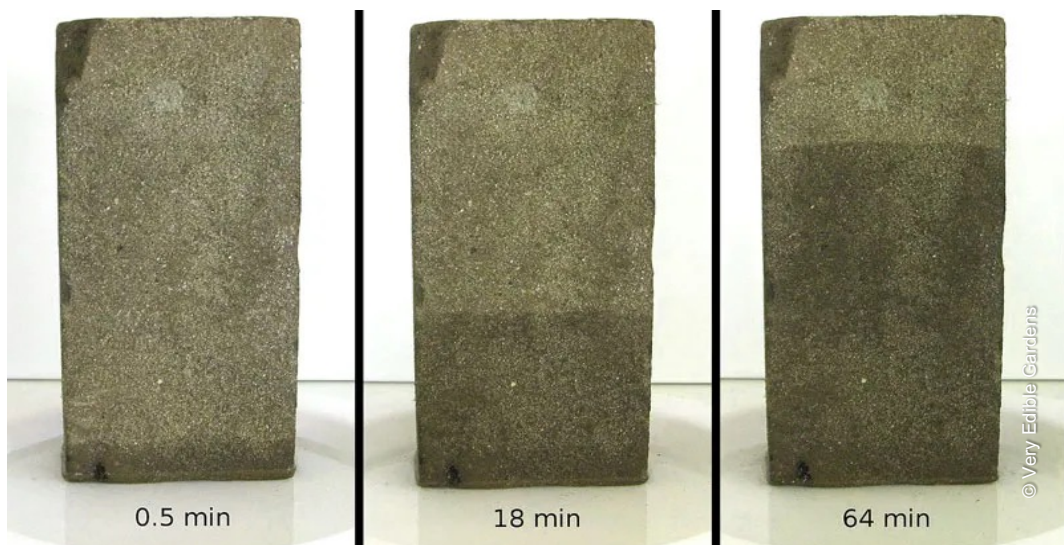


Source: Authors' own elaboration.

## Additional learnings

- Understanding capillary action
- Different bed media for water efficiency
- Closed wicking beds
- Open wicking beds
- Diversification (different plants)
- Intensification
- Controlled environment
- Others

### Capillary Action Experiment



Source: VEG. 2024. Wicking beds. [Cited 2 September 2024] <https://www.wickingbeds.com.au/about-wicking-beds/wicking-bed-science/>

## Key requirements

- Adequate reservoir for water storage.
- Capillary action mechanism for water distribution.
- Properly sized and designed bed structure.
- Suitable organic fill material.
- Adequate drainage.
- Regular monitoring and maintenance.

## Challenges

- Constantly wet soil promotes root rot and fungal diseases.
- Compaction of soil over time.
- Regular maintenance required.
- Risk of root invasion or wicking mechanism clogs.
- High cost for larger setups.
- Challenges adapting for different plant types.
- Logistical issues scaling up for large operations.
- Salt build up affects shallow roots.



## Design Implementation

1. Cut the intermediate bulk container (IBC) tote in half using angle grinder, creating 2 square wicking bed containers. In this suggested design you will use one, where you can apply the same steps for the other cutted container. IBC tote frame will give strong support to the wicking bed.
2. Cut slits in a piece of poly vinyl chloride (PVC) pipe using angle grinder add the plumbing fit in and then the filling pipe with no slits in it.
3. Fasten some shade cloth to the end of the pipe.
4. Position the pipe diagonally in the wicking bed.
5. Half-fill the wicking bed with 10 ml gravel and then level it.
6. Cover the gravel with doubled over shade cloth to separate the next layer.
7. Add soil or red sand and level it, then add a layer of compost then a mulch layer (straw mulch) in the end, mulch is used to reduce evaporation while compost boosts fertility.
8. Plant the desired seedings (vegetables, herbs, leafy crops are usually planted) inside the wicking bed. Water a little on the top of the wicking bed if you need before you plant the seedlings.
9. Create a hole in the side of the tote, above the gravel at the bottom of the soil.
10. Add an overflow outlet using the drill.
11. Fill the water reservoir to add water to the wicking bed.
12. Stop watering once the overflow outlet starts to drip.

## References

1. **VEG.** 2024. Wicking beds. [Cited 2 September 2024] <https://www.wickingbeds.com.au/about-wicking-beds/>
2. **Botanic Garden.** 2024. Building a wicking bed. [Cited 2 September 2024] <https://www.botanicgardens.org.au/discover-and-learn/gardening-home/gardening-tips/building-wicking-bed#:~:text=A%20wicking%20bed%20is%20a%20a,a%20wick%20by%20capillary%20action.>
3. Colin Austin. 2015. Wicking bed – a new technology for adapting to climate change: [Cited 2 September 2024] [https://www.waterright.com.au/wicking\\_bed\\_technology.pdf](https://www.waterright.com.au/wicking_bed_technology.pdf)
4. Leaf Root and Fruit. 2024. Self-watering wicking beds. [Cited 2 September 2024] <https://www.leafrootfruit.com.au/gardens/wicking-beds/>
5. Ray Jess. 2019. Things I Learned About Wicking Garden Beds. Wicking Beds 3.0. The Urban Farm. [Cited 3 September 2024] <https://www.urbanfarm.org/2019/08/13/wickingbeds3-0/>

## Project

Building resilience to cope with climate change in Jordan through improving water use efficiency in the agriculture sector

## Partners

Ministry of Agriculture, Jordan  
Ministry of Environment, Jordan  
Ministry of Water and Irrigation, Jordan  
United Nations Development Programme

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Green Climate Fund

## Geographic coverage

Ma'an, Tafileh, Karak and Madaba Governorates



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